

Research Topic 5: Management Erosion and Sedimentation

Demonstration Site / Number: SA05WB-03

Grower Collaborator: Littabella Pines

Location 2: South Littabella Road, Yandaran

Start Date: April 2019

Outline: To establish and evaluate a sediment catchment pond built within specific guidelines, designed to capture and degrade pesticide and nutrient.

Objectives:

- 1) To build a sediment catchment pond within the current confines of a standard farm layout.
- 2) To evaluate a sediment catchment pond built under specific dimensions to capture the first flush after rainfall events.
- 3) To evaluate the potential to degrade pesticides under certain environmental conditions exacerbated within the sediment catchment pond.

Background / Methodology:

The trial site is strategically located draining into Littabella Creek and subsequently into a High Environmental Value (HEV) area – the Great Barrier Reef marine park.

The research site is the first of two sites, with the second planned for Southeast Queensland.

A sediment catchment pond was constructed under the following parameters:

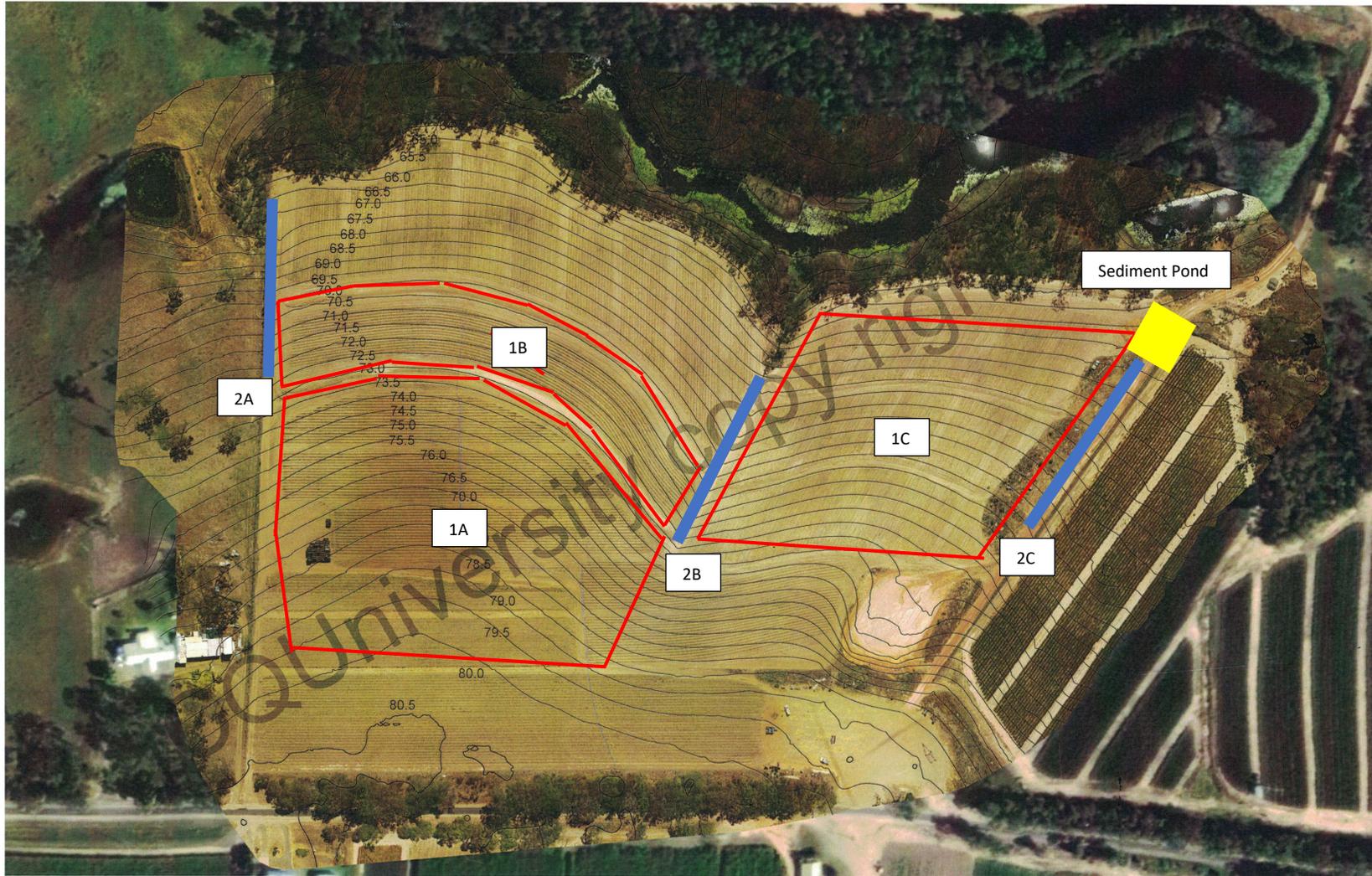
- The dimensions of the sediment catchment pond are designed to capture the first 25 mm flush per hectare. Previous research has indicated the first 25 mm flush contains a significant majority of nutrients and pesticide attached to the sediment. The sediment catchment pond measures 1 m deep, 25 m long and 10 m wide. This is enough to capture 250,000 litres of water or 25 mm per hectare rainfall. The shallow depth of the catchment pond is designed to increase the water temperature and expose the pesticide attached to the sediment to solar radiation.

- The sediment catchment pond is lined with black plastic. The purpose of the black plastic is to further increase the temperature of the water captured in the pond.

This increase in temperature and exposure to solar radiation is hypothesised to breakdown pesticide more rapidly.



Preparation of Research Site



Contour map of trial location (image courtesy of Central Queensland University).

Assessment / Evaluation Method and Delivery Schedule:

Assessment and Evaluation Method	Assessment and Evaluation Delivery Schedule
Rainfall and intensity	0 to 42 months
Water Sample – Pesticide / Nutrient (ppm)	Post rainfall events – 0 to 42 months
Sediment Sample – Pesticide / Nutrient (ppm)	Post rainfall events – 0 to 42 months
Cost analysis (\$/ha)	12 months

Progress Report:

Current Progress: A site has been strategically identified that meets the criteria for monitoring environmental outcomes for the pineapple industry.

April 2019

Grower identified
Site selected
Trial planned

May 2019

Catchment area block has been land prepped
Pre-plant pesticide and nutrition applied

June 2019

Bed-formed
Site planted

November 2019

Sediment catchment pond constructed.

March 2020

Diuron applied
Sediment pond capped

March – September 2020

Sampling and analysis regime begun

January 2021

Sediment un-capped for next stage of investigation

Issues Encountered: Delayed start awaiting outcomes of DES findings for further monitoring sites across industry mitigating off-farm deposition. Planning phase has taken longer whilst working with collaborative partners in this initial site through the PEST group.

Other Notes: Site has been selected for its strategic location – it drains into Littabella Creek which runs into the nearby ocean with the Great Barrier Reef off-shore. Staff are collaborating with Growcom and DAF with on-farm initiatives in this trial.

Results

The key issues of concern for off-farm deposition is sediment, pesticide and nutrient. Sediment is the key component which has been identified as a primary element impacting aquatic species and their habitats. Sediment deposited onto reefs can smother corals and interfere with their ability to feed, grow, and reproduce. Sediment can also act as a carrier for pesticide and nutrients such as Diuron. Pesticides such as Diuron directly kill marine vegetation such as sea grasses which are the fundamental parts of the food chain. Nutrient such as nitrogen can give rise to vegetative species that have a negative impact in aquatic environments such as blue green algae.

After the construction of the sediment pond in November 2019, Diuron, fertiliser and other pesticides were applied over the following months. In summer 2020, the first major rainfall event occurred. The sediment pond captured the first 25mm runoff which consistent significant amounts of sediment. The sediment pond was then capped, restricting no further run-off to enter the sediment pond from any future rainfall events. Water and sediment samples were taken on a monthly basis over the following 7 month period (water within the pond evaporated after 7 months).

A full chemical and nutrient analysis was undertaken for each monthly sample for water and sediment. The impact of heat and solar radiation on pesticide and nutrient concentration levels were tracked over this period.

Progression of Sediment Pond – Five Month Sampling Period



April 2020

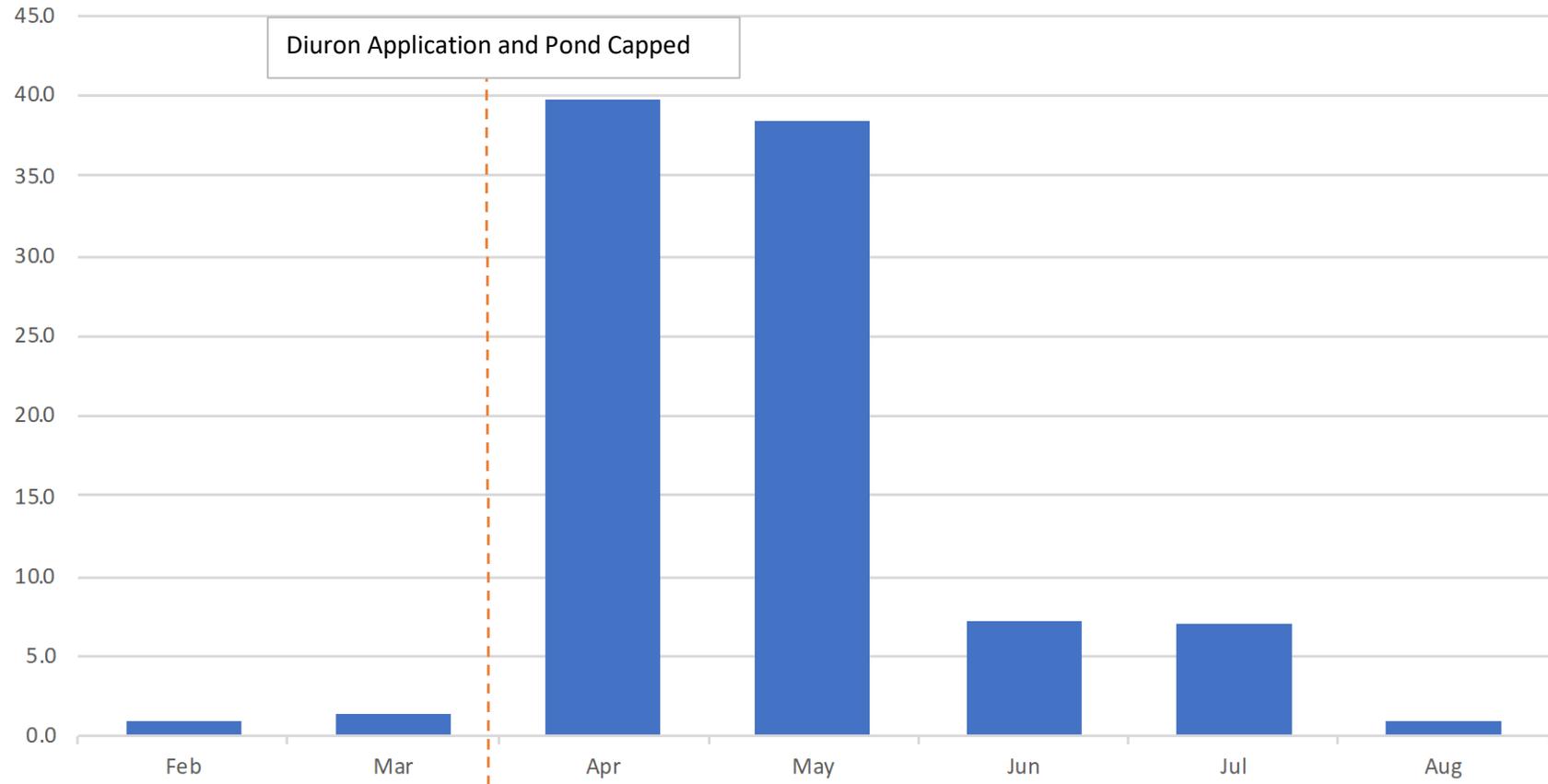


July 2020

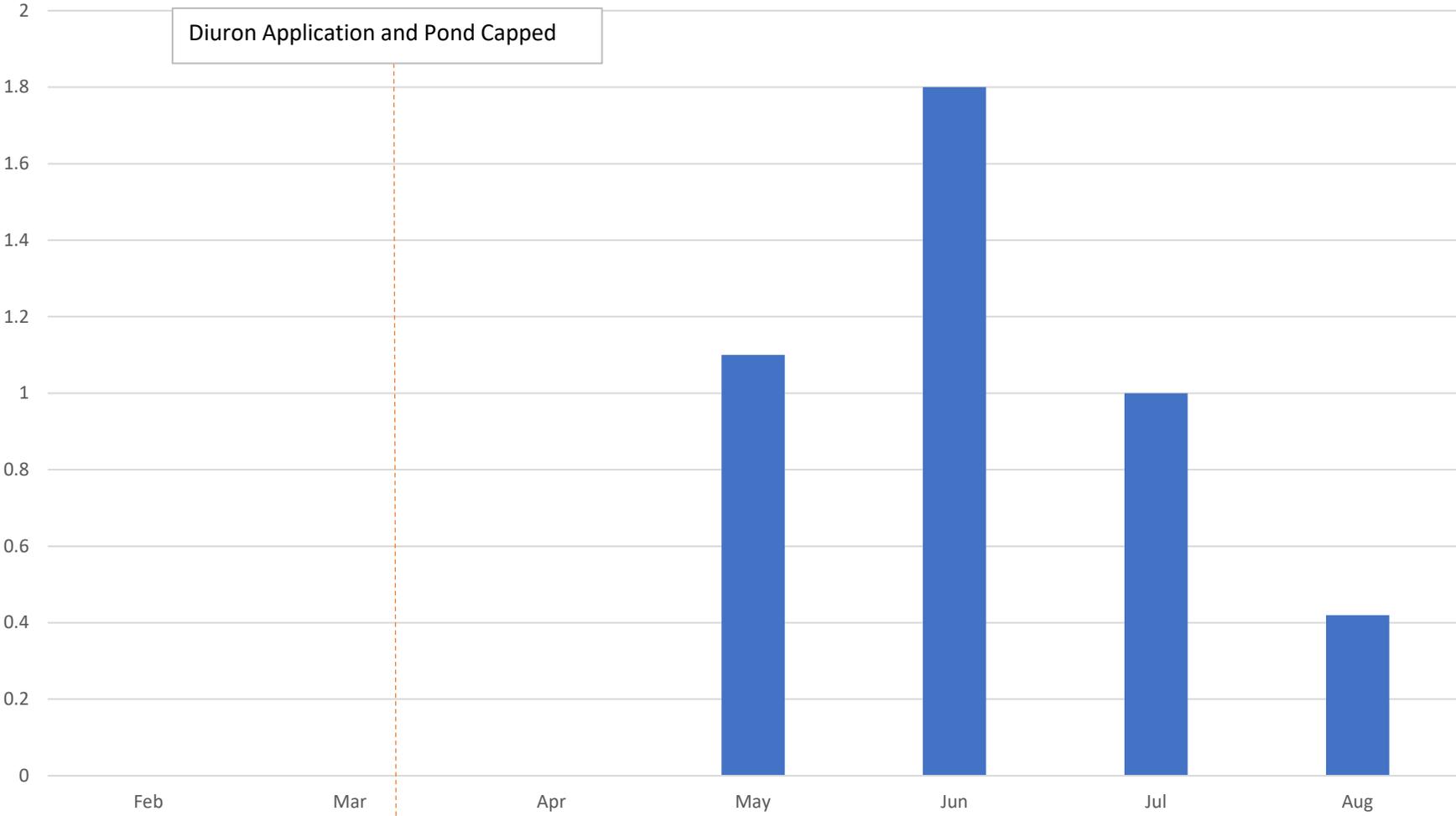


August 2020

Sediment Pond - Diuron Levels in Water (mg / kg)

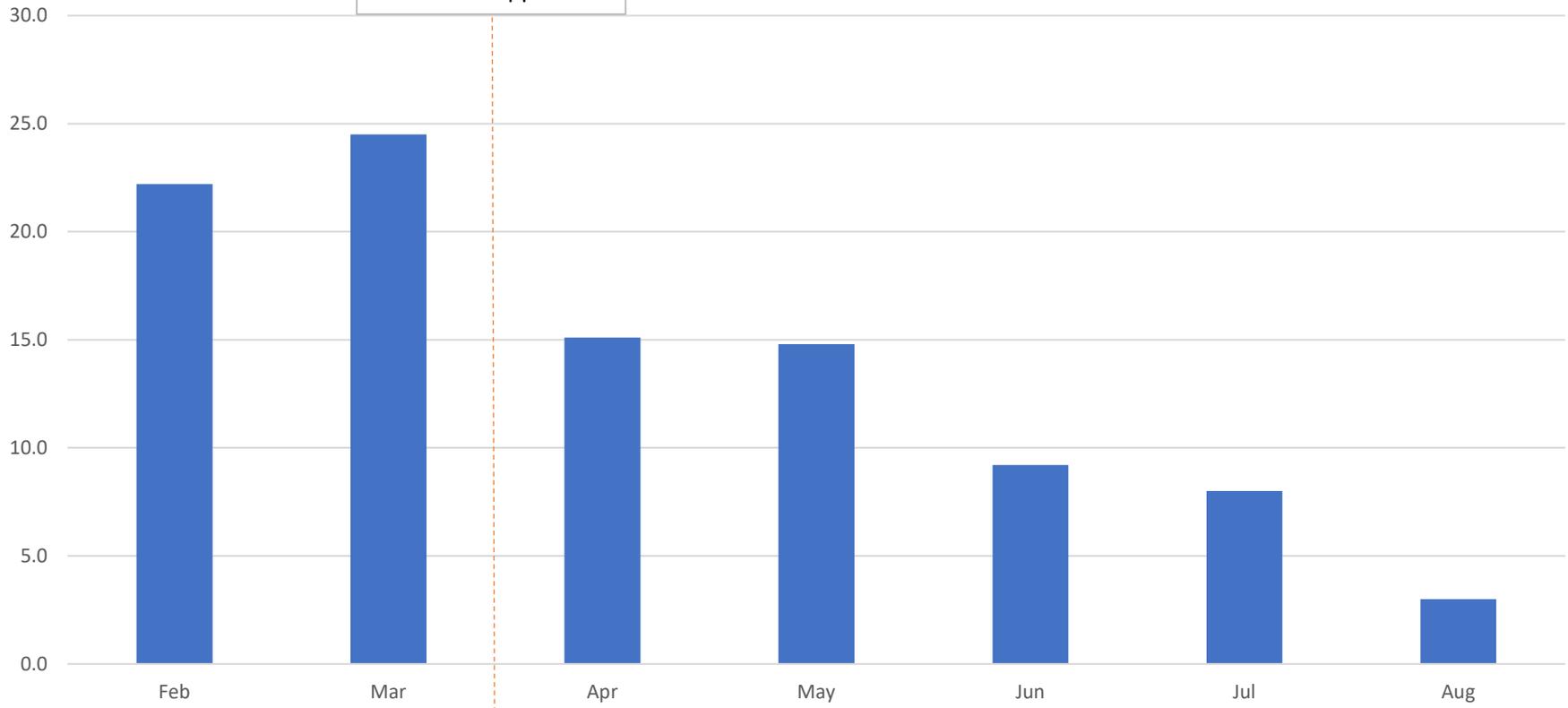


Sediment Pond - Diuron Levels in Sediment (mg / kg)

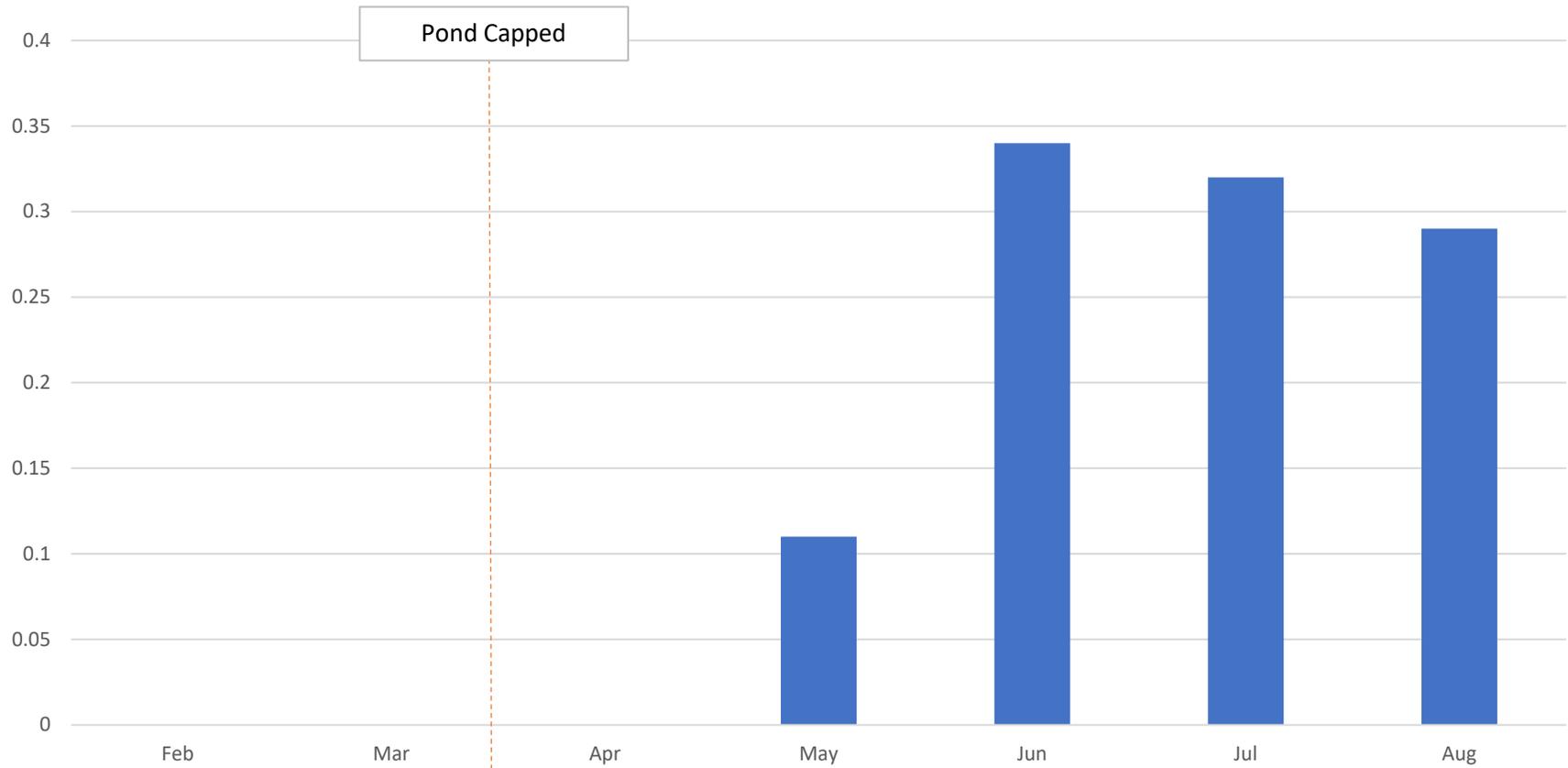


Sediment Pond - Bromacil Levels in Water (mg / kg)

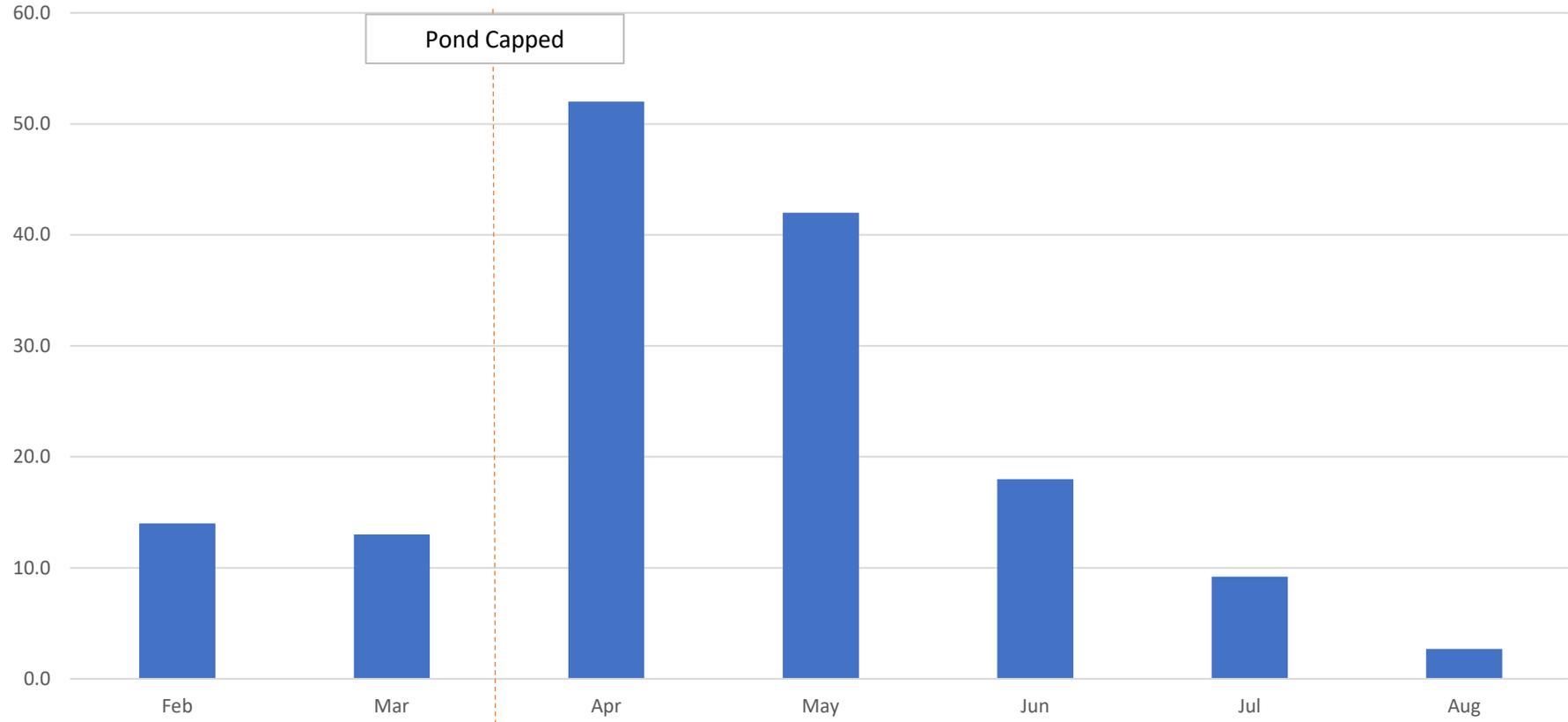
Pond Capped



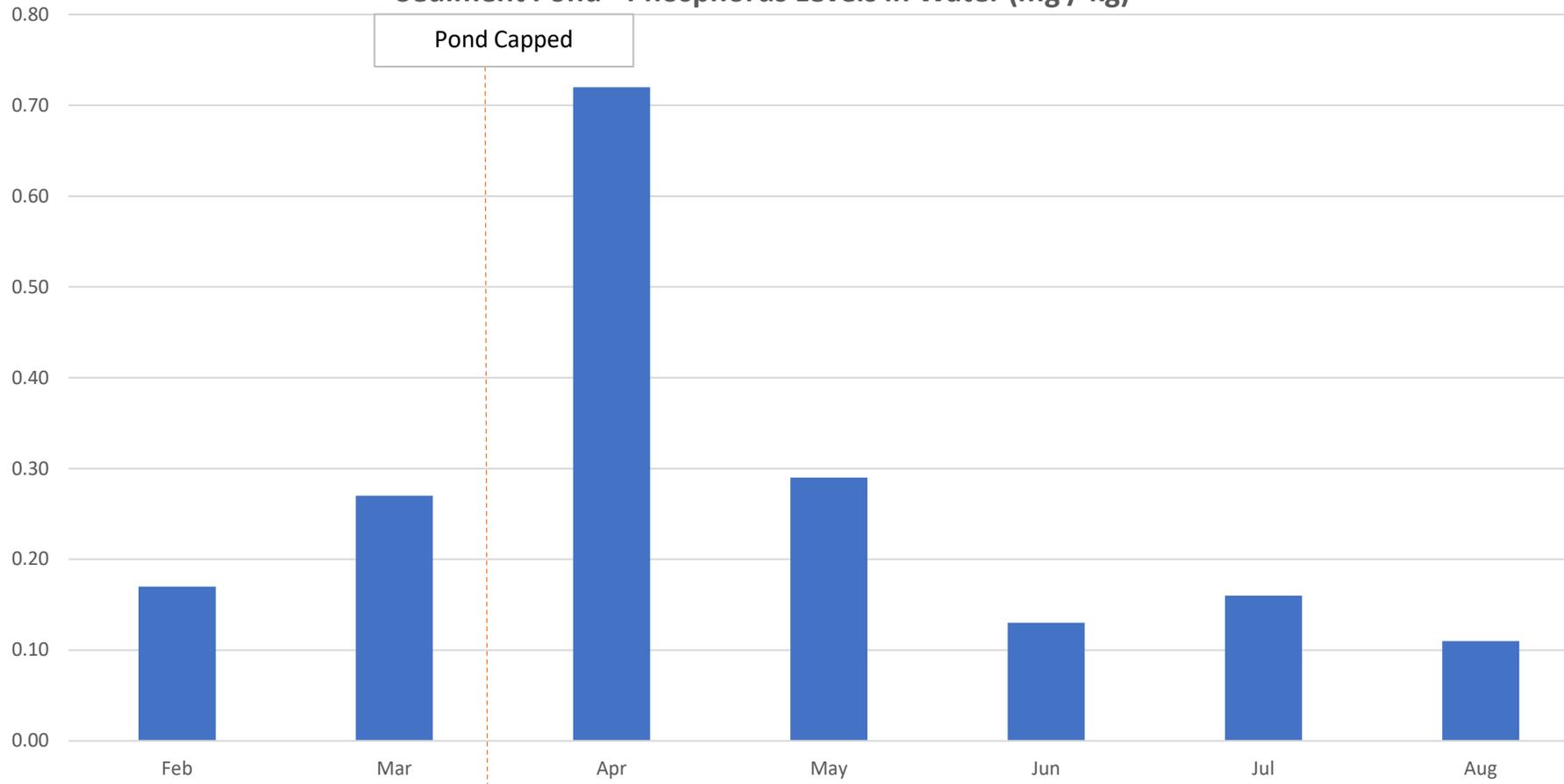
Sediment Pond - Bromacil Levels in Sediment (mg / kg)



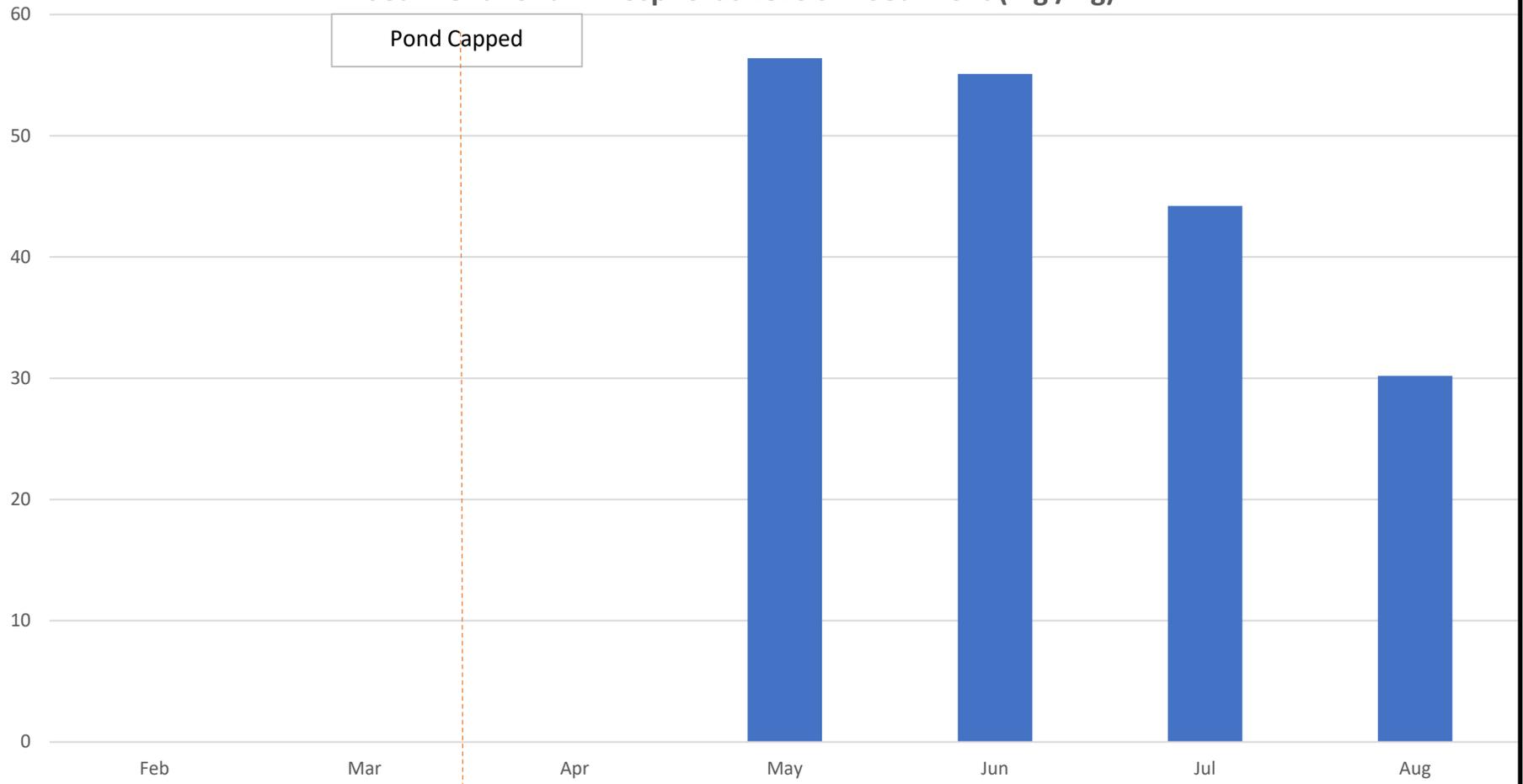
Sediment Pond - Nitrogen Level in Water (mg / kg)



Sediment Pond - Phosphorus Levels in Water (mg / kg)



Sediment Pond - Phosphorus Levels in Sediment (mg / kg)



Diuron

Water Samples

Initial levels of diuron measured 40 mg / kg and declined to less than 2 mg / kg over five months. This is a 95% decrease in levels over the measurement period.

Sediment Samples

Initial levels of diuron measured 1.1 mg / kg in the first month, then 1.8 mg / kg in the second month and declined to 0.4 mg / kg at the end of the five month period. This is a 78% decrease in levels over the measurement period.

The initial levels of diuron present in the water samples were predominantly higher than those measured in the sediment samples.

Bromacil

Water Samples

Initial levels of bromacil measured 15 mg / kg and declined to less than 2.5 mg / kg over five months. This is a 83% decrease in levels over the measurement period.

Sediment Samples

Initial levels of bromacil measured 0.11 mg / kg in the first month, then 0.34 mg / kg in the second month and declined to 0.28 mg / kg at the end of the five month period. This is a 18% decrease in levels over the measurement period.

The initial levels of bromacil present in the water samples were predominantly higher than those measured in the sediment samples.

Nitrogen

Water Samples

Initial levels of nitrogen measured 52 mg / kg and declined to less than 4 mg / kg over five months. This is a 93% decrease in levels over the measurement period.

Sediment Samples

Levels of nitrogen measured over the five month period were all below 0.1 mg / kg.

The initial levels of nitrogen present in the water samples were predominantly higher than those measured in the sediment samples.

Phosphorous

Water Samples

Initial levels of phosphorous measured 0.73 mg / kg and declined to less than 0.12 mg / kg over five months. This is a 93% decrease in levels over the measurement period.

Sediment Samples

Initial levels of nitrogen measured 56 mg / kg and declined to less than 30 mg / kg over five months. This is a 46% decrease in levels over the measurement period.

The initial levels of phosphorous present in the sediment samples were predominantly higher than those measured in the water samples.

Initial Summary

Measurements from the water and sediment samples indicated:

- 1) A substantial decline in measurements across all pesticide and nutrient levels over the 5 month sampling period.
- 2) There was distinct variation in measurements and their decline when comparing the different pesticide and nutrient levels over the five month period.
- 3) There is a clear distinction between different pesticide and nutrient and their predominance in the water or sediment.